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(56) Documents cited

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(54) **A kerb climbing device which minimises vertical acceleration**

(57) A device for use in conjunction with the wheel (14) of a vehicle comprises a foot (10) for contacting the kerb, mounted on an arm (12), the arm being attached via two links (16, 18) to the vehicle suspension. On contacting a kerb the foot lifts the vehicle wheel until the latter contacts the kerb, after which the foot retracts to its original position. The purpose of the two links is to minimise the vertical acceleration as the device lifts the vehicle wheel. The arm, and thus the foot, is spring biased (22) to enable it to retract to its original position.

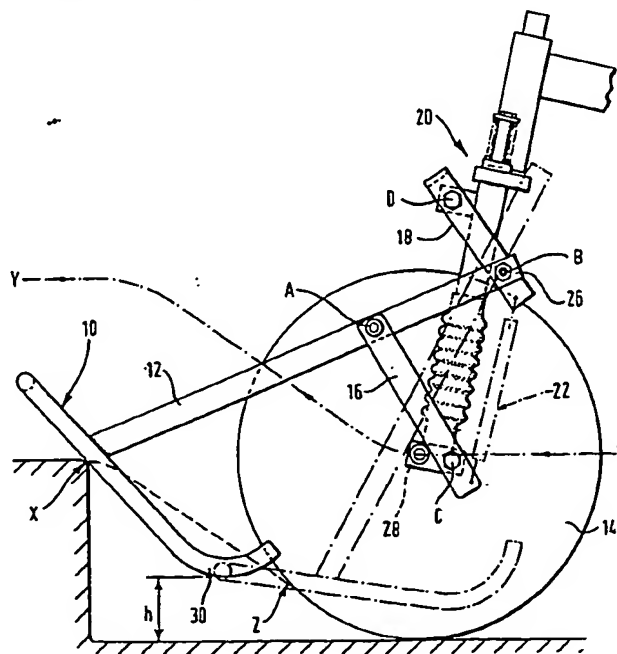


FIG.1.

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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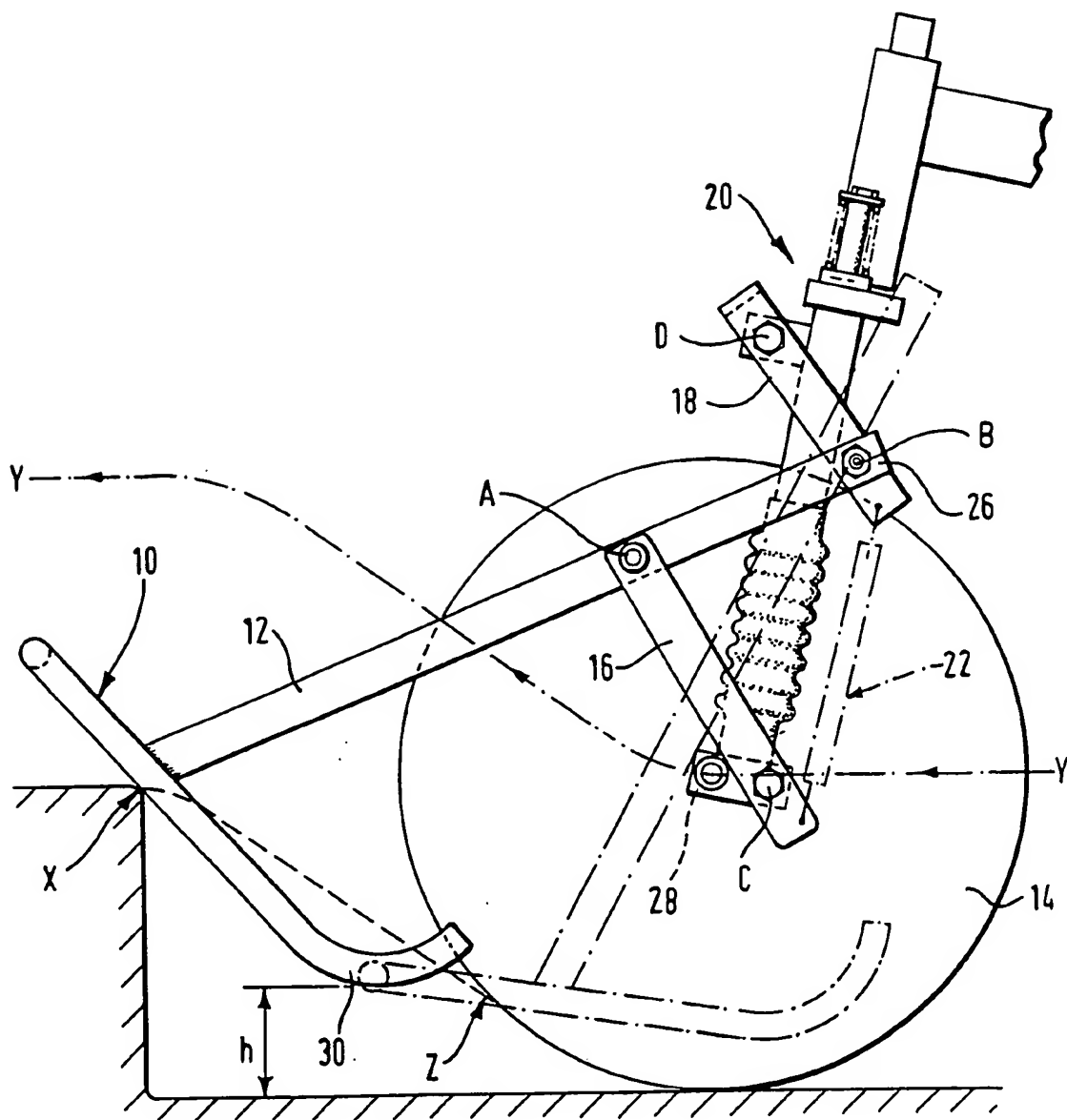
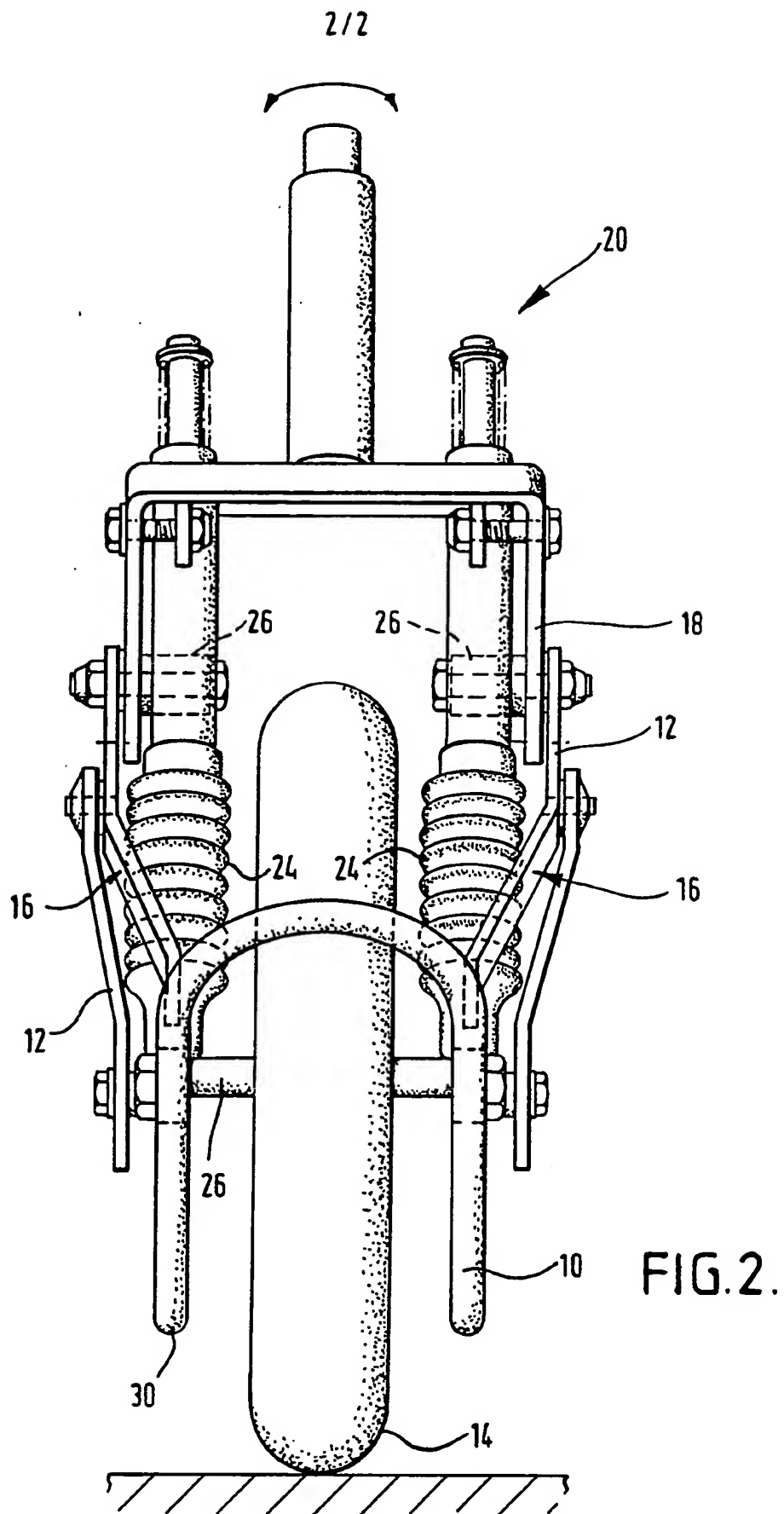


FIG.1.



## IMPROVEMENTS IN PAVEMENT VEHICLES

This invention relates to pavement vehicles and in particular relates to a device for assisting kerb climbing in pavement vehicles used by disabled people.

Pavement vehicles such as electric scooters are available for the use of invalids, disabled or aged and infirm people. Such vehicles need to be able to negotiate kerbs which is extremely difficult if the height of the kerb is more than about half the radius of the wheel. However, it is desirable to keep the wheels as small as possible for other reasons in particular in providing more foot space and keeping the vehicle compact. The user will normally be facing forward when approaching the kerb in order to see where he is going and consequently most of the body weight, and also most of the vehicle weight, acts on the rear wheels. If a high kerb is approached, the usual way to get up is to increase speed and charge the kerb which tends to jerk the front of the vehicle upwards suddenly which, apart from creating discomfort, has a tendency to overturn the vehicle.

Proposals have been made to overcome this problem by utilising attachments which are, in effect, segments of a larger wheel which meet the kerb before the (smaller) vehicle wheel and lift the front of the vehicle until the vehicle wheel can take over without excessive shock. A hinge link and foot have also been used for this purpose. With all such devices, once in contact with the kerb, the point of attachment then moves in a circular arc with its centre at the kerb. Thus the segment or link needs to be large to avoid sudden change in vertical direction of the wheel. There often is not room, owing to the position of the vehicle handlebars, to accommodate a segment or link of the necessary size for a useful lifting effort.

The invention seeks to provide an improved pavement vehicle able to negotiate in safety, kerbs higher than would be expected from the wheel diameter.

According to the present invention there is provided a device for use in conjunction with the wheel of a vehicle which comprises a foot for contacting the kerb mounted on an arm, the arm being attached via two links to the vehicle suspension such that on contacting a kerb the foot lifts the vehicle wheel till the latter contacts the kerb after which the foot retracts to its original position.

Preferably, the arm, and thus the foot, is spring biased to enable it to retract to its original position.

Advantageously the links are so arranged that the motion imparted to the vehicle wheel (and thus to the front of the vehicle) is ramp-like, gradually lifting the front wheel until it contacts the top of the kerb without sudden changes in vertical direction. At the start of lifting the wheel moves in a curved path to give a gradual lift off which is better than would be obtained using a straight sided ramp.

The invention will be described further, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a partial diagrammatic side view of the front wheel of pavement vehicle equipped with a device in accordance with the invention; and

Figure 2 is a front view of the device of figure 1.

Referring to the drawings, the device illustrated is intended for a three wheel electric scooter but can be readily applied to, for example, each front wheel of a four wheel wheelchair or a single mechanism could be mounted centrally between the two front wheels. A U-shaped foot 10 is affixed, e.g.

welded, to the lower extremity of each of two arms 12, one on either side of the front wheel 14 of the vehicle. Each of the arms 12 is in turn pivotally connected at points A & B with links 16 & 18 respectively. The latter are pivotally mounted to fixed points C & D respectively on the vehicle suspension 20. A tension spring 22 connects the extremities of links 16 & 18 biasing them toward one another. The link 18 is also U-shaped to give stability between the two sides of the mechanism and cause the links 16 & 18 to move in unison on either side of the wheel 14.

The vehicle suspension 20 comprises a pair of spring suspension units 24 on either side of the wheel connecting with the wheel axle 26. The fixed points C & D are approximately in line vertically and are nominally a fixed distance from one another. In fact, of course, presence of the suspension units 24 means that the distance between points C & D is not fixed but varies to a degree in accordance with the loading and movement of the vehicle, but such variations do not affect the operation of the device and will be ignored for the remainder of the description.

The "rest" or normal condition of the device is as illustrated in Figure 1 in which the tension spring 22 maintains the lower portion of the foot 10 at a height "h" above the ground. If a kerb of less than height "h" is encountered, the wheel 14 climbs it in the normal way, the device of the invention not coming into operation.

If, on the other hand, a kerb of height greater than "h" is encountered, as illustrated in Figure 1, the edge of the kerb "x" contacts a point on the foot 10. The arm 12 then pivots anti-clockwise as viewed in Figure 1 such that the relative motion between its point of contact with the kerb, "x", is as shown in the chain dotted line "xz" until the wheel 14 itself contacts the kerb at 'z'. At this point the assembly 10,12,16,18 is in the attitude as shown chain dotted in

Figure 1. Here the wheel 14 is in contact with the kerb and the weight transfers from the foot 10 to the wheel, freeing the foot. Action of the spring 22 causes the device to resume its rest position.

As the foot/kerb contact point "x" moves along the line "xz" the axle 25 moves along the corresponding line "y-y" shown in Figure 1 and thus the effect on the vehicle is as if the front wheel were riding up a ramp of shape "y-y" onto the kerb with negligible jerking of the vehicle.

Resilient stops 26 act on the rear of the suspension fork legs to limit the movement of the arm 12 under the action of the spring 22 at the rest position illustrated in Figure 1. Rear limit stops 28 prevent the foot 10 from contacting the wheel when it is in its lowermost position illustrated chain dotted in Figure 1.

Thus the device of the invention only comes into operation when it meets a kerb higher than height "h" when it has the effect of a ramp placed before the kerb enabling the vehicle to climb it smoothly without jerks. The device of the invention allows a 12 inch wheel to climb a 6 inch kerb with ease (whereas previously such a wheel size would have difficulty in climbing kerbs of more than 3 inches). As explained above when the foot 10 contacts the kerb the shape of the coupler curve traced by the point of contact relative to the axis of the wheel provides a gradual start to the lifting of the wheel and the motion of the wheel is a gradual ramp-like motion. A similar motion is obtained whatever height of kerb is contacted. The mechanism is also beneficial for preventing the wheel from dropping into holes.

Preferably, the foot 10 has curved lower portions 30 and is provided with a hard wearing protective surface. If the scooter is reversed off a kerb after the mechanism has moved to its forward position (which is a rare manoeuvre) the

curved rear portions 30 make contact with the kerb and the foot then slides down the kerb till the wheel 14 contacts the ground. Indeed, a modified form of the device may be used at the rear of the vehicle to assist coming down off kerbs without jerking. In this case the action of the spring would be to bias the device in towards the ground instead of away from it. In another alternative, small wheels could be attached to the foot 10 at 30 to reduce friction.

The mechanism of the invention increases the overall length of the vehicle but, in confined spaces such as lifts, if the foot contacts a vertical surface it can be pushed back by the vehicle to its lowermost position so that the increase in length is minimal. Also the curved front of the foot can be used as a door opener for swing doors.

**CLAIMS**

1. A device for use in conjunction with the wheel of a vehicle which comprises a foot for contacting the kerb mounted on an arm, the arm being attached via two links to the vehicle suspension such that on contacting a kerb the foot lifts the vehicle wheel until the latter contacts the kerb, after which the foot retracts to its original position.
2. A device as claimed in claim 1 in which the arm, and thus the foot, is spring biased to enable it to retract to its original position.
3. A device as claimed in either of claims 2 or 3 in which the links are so arranged that the motion imparted to the vehicle wheel (and thus to the front of the vehicle) is ramp-like, gradually lifting the front wheel until it contacts the top of the kerb without sudden changes in vertical direction.
4. A device as claimed in claim 3 in which, at the start of lifting, the wheel is constrained to move in a curved path to give a gradual lift off.
5. A device for use in conjunction with a vehicle substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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